Location-based solutions in the Experience centre

Hansen, Dan Witzner; Alapetite, Alexandre; Holdgaard, Nanna; Simonsen, Celia; Vilsholm, René Larsen

Published in:
Nordisk Museologi

Publication date:
2009

Location-based solutions in the experience centre

Dan Witzner Hansen[1*], Alexandre Alapetite[2], Nanna Holdgaard[1], Celia Simonsen[1], René Larsen Vilsholm[3]

1. IT University of Copenhagen. Rued Langgaards Vej 7. DK-2300 Copenhagen S. Denmark. {witzner, nholdgaard, celiasi}@itu.dk
2. Technical University of Denmark. Department of Management Engineering. Produktionstorvet 426-A, DK-2800 Kongens Lyngby, Denmark. alexandre@alapetite.fr
3. NaturBornholm. Grønningen 30. DK-3720 Aakirkeby. Denmark. Rene.Larsen@naturbornholm.dk

Publication

- In the proceedings of Nodem'2008, conference on Nordic digital excellence in museums, 3-5 December 2008, Reykjavík, Iceland.
- Updated version in the Journal Nordic Museology, 2009/1, section "Eksperimenter, teknologi og museer", pages 44-52. ISSN:1103-8152. Museumstjenesten, Sjørupvjej 1, Lysgaard, DK-8800 Viborg, Denmark.

Abstract

In this paper we present a prototype system for location-based guiding. A user survey has been conducted and the observations are used to support design choices. The prototype allows for both indoor and outdoor navigation at and in the vicinity of the NaturBornholm[1] experience centre in Denmark using a combination of Bluetooth, Near Field Communication (NFC), GPS and QR-codes. Bluetooth, NFC and GPS are used for location-based information and QR-codes are used to convey user preferences.

Keywords

Museum, location-based services, mobile, barcode, GPS, Bluetooth, Near Field Communication, NFC

1 Introduction

Museums, experience centres and tourist organisations continuously try to improve their exhibitions or attractions via a higher degree of user participation and by looking at new and interesting ways to stimulate the user experience and increase dissemination.

Location-based services are obvious choices for disseminating knowledge and information in outdoor environments and bridging the gap between indoor exhibitions and outdoor attractions.

[1] http://naturbornholm.dk

Several examples of GPS-based systems are currently being experimented with and new ones are being built. Other electronic information systems based on Bluetooth® technology are being investigated[2] for indoor use (e.g. the transfer of multimedia contents and location information). Each of these technologies has its particular strength and weaknesses in terms of applicability to various conditions. For instance, GPS is only appropriate outdoors.

Internationally, a related example is the Ubiquitous Museum,[3] where the concept is about displaying posters with QR-codes around the district of Marunouchi (Tokyo, Japan) containing online stories and tourist information. There is also an experience centre in the United Kingdom aiming to provide visitors with location-based information about the surroundings of various seaside locations via 2D barcodes (O'Hara & Kindberg, 2007).

In some cities in Denmark, visitors can be guided by using QR-codes and downloading audio files to their mobile phones[4]. More generally, the concept of using barcodes for carrying information, identification, payment and preferences (for example) from one computer to another via the user's mobile phone is used for so-called "mobile-ticketing". This has several large-scale uses, such as the recent 2D-barcode adoption by IATA for check-in[5] with mobile phones at airports (International Air Transport Association, October 2007).

The project presented here investigates the possibility of combining technologies that allow museum visitors to prioritise and customise the information by creating a profile before the visit, while allowing this visitor to bring selected information from inside the museum to the surrounding area outside.

2 Preliminary user survey

In this section, we present the outcome of surveys and interviews conducted in the spring of 2008 regarding expectations and prior understandings regarding museums and the museum visit. We received 138 answers to an Internet questionnaire from actual and potential museum visitors aged 14–71 across Denmark. Additionally, a focus group interview involved seven girls from the tenth class at Roskilde Tiendeklassecenter.

On the one hand, our respondents find museums to be uninteresting, rigid, and too elitist (Figure 1), but on the other hand they expect to have a learning experience, have a nice time with friends and family, and use the museum visit in their impression management (Goffman, 1959) (Figure 2).

[2] http://www.kulturarv.dk/tjenester/kulturnet/stoettede_projekter/2008/

[3] http://map.elp.or.jp/umm.html

[4] http://www.visithorsens.dk

[5] http://www.iata.org/pressroom/pr/2007-11-10-01.htm

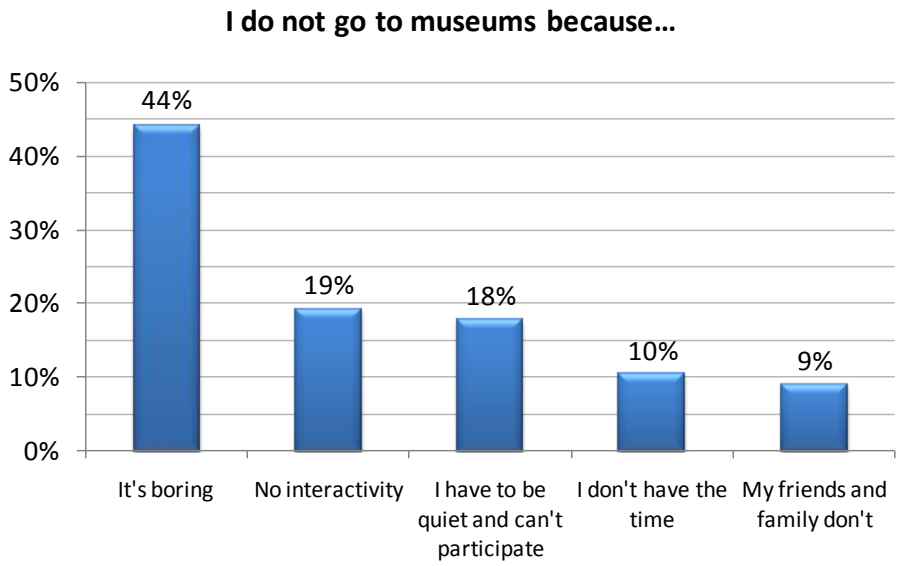

Figure 1: Reasons for not visiting museums, N = 138. The respondents could choose three answers.

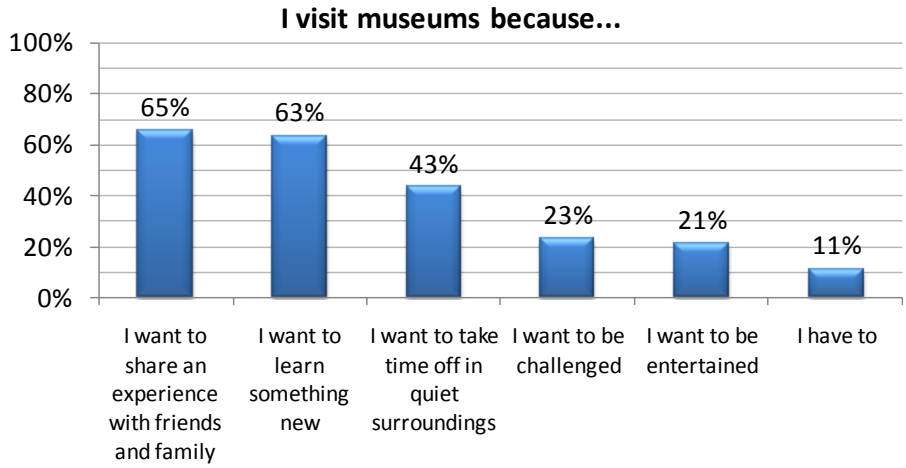

Figure 2: Reasons for visiting museums, N = 138. The respondents could choose three answers.

44 percent of our respondents reported that one of the reasons they do not visit museums is because they do not have the time, implying that these respondents do not consider museum visits as a spare time activity they wish to prioritise. 23 percent answered that they neither find museums nor the museum experience interesting or fun. This could be due to a lack of interactivity and to the traditional nature of museum surroundings (Figure 1).

- "I miss interactivity in the exhibitions. More dialogue between the exhibitions and us – all the senses should be stimulated and multiple learning styles should be available." (male, 34)

Some respondents expressed that "It's a problem you have to read long, heavy texts to get information" (female, 29), and emphasized a feeling of being passive and inactive in museum settings.

We found that the respondents who frequently visit museums find the museum experiences entertaining, thus bringing their family and friends. Still, they expect to learn and get challenged, and in this sense strongly indicate that the museums have to facilitate these opportunities (Figure 2).

At NaturBornholm, families with children are the largest visitor group, and the results show that this visitor group stresses the need for more collaborative learning, customisation of information according to age and knowledge level, and social interaction in museums in order to accommodate children's needs:

- "More things children can try, touch and experience." (female, 31)

Despite this, it is important to take into consideration that not all visitors are likely to find the possibilities offered by new technology interesting: "It might be the future, but not for me. I do not think I would know how to use any of it. It is mostly for young people." (female, 60). Maybe she will never be tempted to use a digital platform, but nevertheless this emphasizes the need for devices to be intuitive and easy to use, as well as the need for thorough instructions and help on-site.

According to the Danish Ministry of Culture, the use of digital media is a necessity to reach young visitors in particular, as they constitute an under-represented visitor group in museums (Kulturministeriet 2006). Surprisingly, the teenagers in our research did not share this opinion.

- "I do not think technology can make me more interested in museums. Why does everything need to have something to do with technology and mobile phones? It can easily become too much." (female, 14)

As 'digital natives' (Prensky 2001), teenagers do not perceive digital media as something special – it is part of their day-to-day life. This means they do not share the museum's enthusiasm concerning digital and interactive platforms. According to the teenagers, the technology should always mediate and support relevant, meaningful experiences.

Generally our respondents did not explicitly express a need for digital or technological museum guides and did not comprehend in what way digital technology could contribute to a greater and more engaging experience, thus suggesting that an appealing presentation of the possibilities of such systems is an important prerequisite. In other words, the digital device or technology itself is not sufficient, and as such it is always necessary to keep this in mind in order not to fall into the 'technological trap' (Šola 1992).

2.1 The experience steps

According to our user surveys, a visit to a museum or experience centre usually involves several steps:

1. Before the visit, the visitor may examine the museum's homepage to get specific information and learn about its exhibitions or collections. It is important not only to convey information that the visitor already knows about, but also to provide

personalised suggestions about related material that they may not know about. Transferring these user preferences seamlessly is crucial to ensure user acceptance.

2. During the visit, the visitors experience the exhibition and may realise new and interesting topics that they would like to explore further. The user-specific preferences should be reflected in the information that is presented to visitors at the experience centre or museum. In terms of guided tours, this may result in different data to be presented and even different directions to go.
3. After the museum visit, the visitor may go to other locations presented in the museum or experience centre or go home and share the experience with family, colleagues, etc.

In developing new interactive guides for museums, experience centres or other cultural heritage institutions, these steps should be taken into consideration.

2.2 NaturBornholm

NaturBornholm is an experience centre in Aakirkeby on the Danish island of Bornholm. The scope of the centre is to provide easily accessible information about the past and present nature of Bornholm to the general public in a dedicated and committed manner. NaturBornholm is both educational and entertaining. The core elements are interactivity, dialogue with nature interpreters and active participation. To arouse the visitor's curiosity and enhance the experience, all five senses are stimulated.

In the centre's experience hall (Figure 3), the visitors are encouraged to gain hands-on experience in order to develop a greater understanding of the nature on Bornholm. The exhibition hall is a journey through Bornholm's past and present. The exhibition begins with a virtual journey trough time, starting 1 700 million years ago. This passage through time consists of an animation with additional physical effects, which enable visitors to experience the formation of the island of Bornholm.

Figure 3: NaturBornholm, indoors. Photo: Finn Hansen, NaturBornholm

The largest group of visitors at NaturBornholm is families with children (~96%, amounting to about 62 000 people annually) who visit the centre as a holiday activity. During weekdays, a large number of schoolchildren and high school students visit the centre as well.

3 Naturl-IT

As mentioned above, the use of handheld devices such as PDAs, multimedia players and mobile phones as guides within museums is becoming common. At the same time, the telecom statistics from the Danish National IT and Telecom Agency show that approximately 93% of the Danish population owns a mobile phone, which is higher than any other portable electronic device (IT og Telestyrelsen, 2007). Furthermore, mobile phones have a number of relevant features – such as camera, GPS, Bluetooth, web browser, and multimedia player – and the great advantage that users are normally familiar with their particular device. With this in mind, NaturBornholm chooses to target the mobile phone platform.

NaturBornholm is currently relying on the visitor to bring printed material with them around the museum – as are other museums and experience centres – so that it can be read in the vicinity of the intended locations, inside the museum or outside. It is therefore a risk that visitors may lose important information by not reading the text in the intended location, walking in the wrong direction, and become overly distracted or tired of reading large amounts of text (as mentioned in the previous section).

Embedded technologies have considerable potential to improve the user experience both during the visit and afterwards. Mobile devices also have the added benefit of reducing some of the limitations of printed material mentioned above, although they come with a new set of issues such as usability, accessibility and technical issues.

The name of the project presented in this paper is Naturl-IT, and the aim of the project is to offer visitors a possibility to experience and receive information and knowledge about the nature of Bornholm – both inside NaturBornholm and around the island; in particular by displaying audio, video and text at the right location and at the right time, taking individual user preferences into account. Each visitor has different preferences regarding what he or she likes to see and hear. Among others, there are preferences for the standard school class, family and the advanced visitor interested in geology or botany. The current implementation relies on GPS for outdoor localisation, Bluetooth and, if available, Near Field Communication (NFC) for indoor localisation. The user interface is kept simple with only a few buttons to press on a touch-screen (Figure 4). When a visitor reaches an intended location, the phone vibrates as notification. The visitor can therefore keep the mobile phone wherever appropriate and only take it out when needed. The electronic services should not be the prime focus for the visitor, but rather supplement the exhibition and provide an extra dimension.

Figure 4: Screenshot of the Naturl-IT software running on a mobile phone, displaying some multimedia material for a given location.

In order to interact to a greater extent with the visitors, the project also involves the use of 2-dimensional barcodes, more precisely QR-codes ("Quick Response", ISO/IEC 18004:2000). While QR-code (Figure 5) is not the sole 2-dimensional standard, it seems to be the most broadly supported on mobile phones, which are often shipped with built-in readers, for most models in Japan, and some models in Europe, such as Nokia[6] N93, N95, N96 and E90, some telephones based on the Android platform (Google), and other models, depending on mobile phone companies' branding campaigns. Freeware readers are also available for most mobile phone platforms (Java ME, Symbian, Windows Mobile, Google Android, Apple iPhone, etc.), e.g. Kaywa[7] Reader, i-nigma[8] Reader and QuickMark[9]. Given some large-scale use, in particular for mobile ticketing, it is reasonable to expect average users to become familiar with this technology in the near future, also in Europe.

[6] http://mobilecodes.nokia.com

[7] http://reader.kaywa.com

[8] http://www.i-nigma.com

[9] http://www.quickmark.com.tw

Figure 5: A QR-code containing a simple Web address:
http://naturbornholm.mobi

3.1 Detailed user scenario

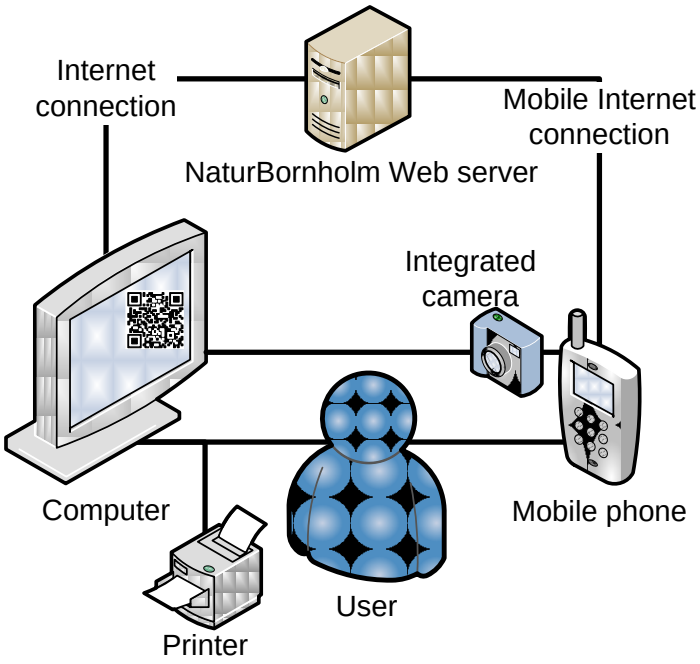

Figure 6: Typical user setup at home, preparing for the museum excursion.

The suggested user scenario for the Naturl-IT project is divided into three main steps.

1. At home: While preparing the visit, the users are offered a set of options to choose from on a Web page. When the selection is done, the preferences are encoded into a QR-code that is displayed on the screen (Figure 6). It is possible to save this tag by printing it on paper, which is particularly useful to distribute the same preferences to a whole group of visitors, e.g. a group of school children.

A more elaborate solution is to transfer those preferences on the user's mobile phone (requires a mobile Internet connection). If the mobile phone is not equipped with a 2D barcode reader, the user is guided to install one. Once the barcode reader is running on the mobile phone, a simple screenshot of the QR-code displayed on the computer screen will instantly point the mobile phone's Web browser to the same Web page with the same preferences (i.e. Web session), thanks to the barcode containing a specially formatted URL of the following form:

```
http://example.net/profile?preferenceA=choice2&preferenceB=choice5
```

At this step, the preferences are stored in a cookie on the user's Web browser. If this was not completed from home, or if any modifications are requires, on-site kiosk computers offer the same facilities. Further information on this technique can be found in [Alapetite 2009].

2. At the museum: The Naturl-IT application can be downloaded free of charge from a kiosk. The preferences can be communicated to the kiosk in three different ways: by presenting the printed barcode to the kiosk's webcam (not implemented yet), by using the mobile phone to scan a barcode displayed on the kiosk screen (the cookie of step 1 will be received by the kiosk; requires a mobile Internet connection), or by inputting the preferences manually on the kiosk (similar to step 1). The kiosk then broadcasts the application and selected content via a short-range Bluetooth connection (10cm) and the user only has to accept it on the phone interface.

3. Outside the museum: When the Naturl-IT application is running, it will automatically react to location changes by providing corresponding information as described in the previous section. Some barcodes containing a location-specific URL can also be displayed in selected areas, offering some online multimedia content to users who do not have the Naturl-IT application running (there is a risk of this being expensive for users without a suitable mobile data plan).

A few technical tricks can be used to make the above procedure more user-friendly. Firstly, it is possible to detect the type of mobile phone (via Bluetooth, and over mobile Web) to provide optimised solutions. If installed, it is also possible to auto-start the Naturl-IT application after the user has scanned a barcode with his/her mobile, by sending a file with a specific MIME[10] type and extension to the mobile phone. Finally, when the Naturl-IT software is running, it can catch some specific Internet addresses to handle them locally (via DNS[11] redirection to "localhost"); this is especially useful to enhance QR-codes that contain a simple URL, in particular to avoid mobile Internet connection fees.

[10] Multipurpose Internet Mail Extensions

[11] Domain Name System

4 Conclusion

We have presented Naturl-IT; a general principle for location-based services combining Bluetooth, NFC, camera and GPS into one system. We have shown that the mobile phone platform can be used for conveying information to visitors both indoor and outdoor. We have used NaturBornholm as a user case for combining information learned in the exhibitions to those observed outside for preferences-based guided tours. Finally, we have presented ideas on how camera-phones can be used for transferring user preferences between mobile phones and computers in a robust and user-friendly manner. It is relevant to note that the authors expect an increase in the proportion of European mobile phones shipped with a 2D barcode reader pre-installed – as it is already the case in Japan – which will make the proposed procedures easier for the users.

We believe that Naturl-IT is a concept that will bring another dimension to the museum and learning experience at NaturBornholm, and as such, Naturl-IT is a unified whole which is made possible by the technology presented in the paper.

Naturl-IT is not finished yet, and many points are still to be investigated. For instance, location-based games could be a vector to improve user participation and knowledge dissemination. At the moment, the system only supports phones based on the Windows Mobile platform. In time, we hope that other platforms, such as Java ME, will be supported.

Regarding privacy concerns, it is interesting to note that users carry their own preferences, either on paper or on their mobile phone. There is neither a need for a central database nor for a login with a user account, which reduces privacy threats.

We are working on various ideas for improving the display of data and the interaction principles on the mobile device, as this is the major barrier to user acceptance. The use of preferences and providing suggestions to the user will be better implemented, as it is going to play an important role in the museums and experience centres of the future.

5 Acknowledgments

The work is partly supported by Danvifo[12] via support from the Danish Ministry of Science, Technology and Development and from the European Social Fund via the "Ud i naturen – Året rundt" project.

6 References

Alapetite, Alexandre (2009). Dynamic 2D-barcodes for multi-device Web session migration including mobile phones. Personal and Ubiquitous Computing, online 2 April 2009. doi:10.1007/s00779-009-0228-5

Danish Ministry of Culture (2008): "Digitalisering af kulturarven". Visited 16 September 2008. URL: http://www.kum.dk/sw75990.asp

Goffman, E. (1959). The Presentation of Self in Everyday Life. New York & London. Anchor Book. Double Day.

IT og Telestyrelsen (2007): "Telecom statistics – second half of 2007". Visited 3 September 2008. URL: http://en.itst.dk/statistics/telestatistik/halvarsstatistik/2007/half-year-statistics-second-part-of-2007

Kulturministeriet (2006). Udredning om museernes formidling. København: Kulturministeriet.

O'Hara, Kenton, Kindberg, Tim (2007). Understanding user engagement with barcoded signs in the 'Coast' location-based experience. Journal of Location Based Services, 1(4), 256–273. doi:10.1080/17489720802183423

Prensky, Marc (2001). Digital natives, digital immigrants. On the Horizon, 9(5), 1-6. doi:10.1108/10748120110424816

Šola, Tomislav (1992): The Future of Museums and the Role of Museology. Museum Management and Curatorship, 11, 393-400.

[12] http://www.danvifo.dk